

# Abdurrouf

Portfolio: aabdurrouf.github.io

Github: github.com/aabdurrouf

ORCID ID: <https://orcid.org/0000-0002-5258-8761>

Email: [abdurrouf@asiaa.sinica.edu.tw](mailto:abdurrouf@asiaa.sinica.edu.tw)

Mobile: +886-90-560-6672

## EDUCATION

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- **Astronomical Institute, Tohoku University** Sendai, Japan  
*Doctor of Science - Astronomy; GPA: 4.0/4.0* October 2015 - September 2018  
*Thesis: Spatially resolved stellar mass buildup and quenching of star formation in massive disk galaxies over the last 10 Gyrs*
- **Astronomical Institute, Tohoku University** Sendai, Japan  
*Master of Science - Astronomy* October 2013 - September 2015  
*Thesis: Star formation mode of galaxies in the local universe with spatially resolved star formation rate and stellar mass*
- **Physics Department, Brawijaya University** Malang, Indonesia  
*Bachelor of Science - Physics* September 2009 - September 2013

## PROFESSIONAL EXPERIENCE

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- **Postdoctoral Fellow** November 2018 - Present  
*Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)* Taipei, Taiwan

## AWARDS

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- Japanese government MEXT (Ministry of Education, Culture, Sports, Science, and Technology) scholarship for Master and Doctor studies - (2013 - 2018)
- Silver medal in Physics field of the National Olympiad of Mathematics and Natural Sciences for undergraduate student in Indonesia - 2013
- Silver medal in Physics field of the National Olympiad of Mathematics and Natural Sciences for undergraduate student in Indonesia - 2012

## LEADERSHIP OR MANAGEMENT ACTIVITY

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- Co-chair of a monthly meeting at ASIAA on the updates and science results related to the projects/surveys with the Subaru telescope. The meeting is attended by a group of four faculties, more than five postdocs, and students - (2019 - 2021).
- System administrator of a group's computer cluster at ASIAA - (2019 - Present).

## RESEARCH INTERESTS

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- Galaxy formation and evolution, in particular, the structural evolution of galaxies and the physical mechanisms that are responsible for the quenching of star formation in galaxies.
- Modeling the panchromatic spectral energy distribution (SED) of galaxy and the development of statistical methods to extract the underlying stellar population properties of galaxies from their SEDs.
- Connection between galaxy and the dark matter halo.
- Simulation of galaxy formation and evolution.
- Observational cosmology

## MEMBERSHIP IN RESEARCH PROJECTS

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- **External collaborator:** Local Universe Science Working Group in the Euclid Consortium (2021 - Present)
- **Scientist:** Galaxies Science Collaboration of the LSST (2021 - Present)
- **Scientist:** Dark Energy Science Collaboration of the LSST (2021 - Present)
- **Scientist:** SDSS IV/MaNGA (2019 - Present)

## SERVICE TO THE SCIENTIFIC COMMUNITY

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- **Referee:** the Astrophysical Journal (ApJ).

## SOFTWARE SKILLS

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- **Languages:** Python, C++, C, Delphi
- **Develop software:**
  - **piXedfit (pixelized SED fitting):** A Python package for analyzing spatially resolved spectral energy distributions (SEDs) of galaxies. This Python package provides modules for image processing, spatial-matching between broad-band imaging data and integral field spectroscopy (IFS) data, pixel binning, and SED fitting with Bayesian approach (using two posterior sampling methods: MCMC and random dense sampling of parameter space). Detailed description of the software is provided at [Abdurro'uf et al. \(2021a\)](#).
  - **Accurate Hijri Calculator (AHC):** A software (written in Delphi) for calculating a map of visibility of a new crescent of the moon at a sunset time that marks the beginning of a new month in the Islamic lunar calendar. I developed this software for my Bachelor thesis project in 2012-2013. This software has been used by many people in Indonesia and recently become the main tool for determining the beginning of important months in annual Islamic traditions (ceremonials) by the Ministry of Religion of Indonesia. Some related links: [link1](#), [link2](#) (press conference), [link3](#).
- **Proficiency in using software:** IRAF, SExtractor, emcee, Astropy, Photutils, Matplotlib, Specutils, FSPS.
- **Experience in using computer clusters:** I heavily use TIARA and SUMIRE clusters at ASIAA for my researches.

## SELECTED CURRENT AND PAST RESEARCH PROJECTS

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- **Dissecting nearby galaxies with piXedfit** 2021 - Present
  - *Working in progress; Role: principal investigator (leader)*
  - **Goals:** Analyzing spatially resolved properties of the key baryonic components (stars, gas, and dust) in nearby spiral galaxies.
  - **Outputs:** Abdurro'uf et al. (2021b), and two papers in preparation that will discuss: (a) local kpc scaling relations among the properties of the stellar, dust, and gas components; (b) resolved dust-to-gas mass and dust-to-metals ratios and the crucial effects of the CO-to-H<sub>2</sub> conversion factor.
- **Development of a pipeline for spatially resolved SED fitting on future *Euclid* data** 2021 - Present
  - *Working in progress; Role: external collaborator (primary contributor)*
  - **Goals:** This is a task as part of the working package on *Physical Parameters and Redshifts (PPZ)* of the Local Universe Science Working Group (LU-SWG) in the *Euclid* collaboration. In this working group, I am leading the development of a pipeline for conducting spatially resolved SED fitting on local ( $0.2 < z < 0.3$ ) and nearby ( $D=100-200$  Mpc) galaxies using future imaging data from *Euclid*.
- **Direct measurement of SMBH mass of a massive quenched galaxy at  $z = 2.1$**  2021 - Present
  - *Working in progress; Role: co-investigator*
  - **Goals:** Investigate the mechanisms that cause the quenching of a massive ( $\log(M_*/M_\odot) \sim 11.15$ ) galaxy at  $z = 2.145$  that shows an evidence of hosting an AGN. Our proposed high-resolution ALMA observation will reveal a 2D kinematic map of gas within the central 1 kpc region at a spatial resolution of 75 pc and provide a direct probe for measuring mass of the super massive black hole (SMBH). This will be the first direct measurement of SMBH mass in a quenched galaxy beyond the local universe.
  - **Progress:** The proposed ALMA observation has been carried out and we are now analyzing the observational data.
- **Study of the nature of isolated massive slow rotating early-type galaxies** 2019 - Present
  - *Working in progress; Role: co-investigator*
  - **Goals:** Conducting a dense redshift survey of galaxies in the immediate surrounding of a rare sample of 6 massive ( $\log(M_*/M_\odot) > 11.0$ ) slow-rotating early-type galaxies in the local universe to determine whether they are living in an isolated environment (as suggested by previous studies) or they actually belong to a rare class of objects known as the *fossil groups*. In either case, these observations are guaranteed to produce important results.
  - **Progress:** We have been conducting the observational campaigns since 2020. I have heavily contributed to this project, especially on the proposal writing and preparing the target catalogs for each observation.
- **Study of the abundance and nature of massive, bulge-less galaxies in the local universe** 2019 - Present
  - *Working in progress; Role: co-investigator*
  - **Goals:** Conduct a census of massive, bulge-less disk galaxies (MBGs) in the local universe using the velocity dispersion ( $\sigma$ ) maps from the MaNGA survey. Then, compare the number (i.e., fraction) with that predicted from the cosmological simulation IllustrisTNG.
  - **Progress:** I have constructed radial profiles of  $\sigma$  for around ten thousands galaxies currently observed by MaNGA and are determining a statistical method (i.e., criteria) for selecting MBGs.
- **Development of piXedfit software** 2019 - 2021
  - *Role: leader (developer)*
  - **Goals:** Develop a Python package that provides a self-contained set of tools for measuring spatially resolved properties of the stellar populations and dust in galaxies using multiwavelength imaging data alone or in combination with IFS data.
  - **Outputs:** piXedfit software ([Github](#)), and Abdurro'uf et al. (2021a).
- **Study the spatially resolved stellar mass buildup and quenching of massive disk galaxies** 2014 - 2018
  - *Finished; Ph.D. thesis project*
  - **Goals:** Study how massive disk galaxies build their internal stellar mass structures and quench their internal star formation activities over the last 10 Gyrs.
  - **Outputs:** Abdurro'uf & Akiyama (2017,2018), and initial development of codes that later become piXedfit software.

## MENTORING OR TEACHING ASSISTANCE

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- Served as a mentor in one week workshop on astronomical data analysis for undergraduate student from the University of Science and Technology of China (USTC) which was held by the Astronomical Institute, Tohoku University, Japan - (September, 2016). (link)
- Teach electrodynamics class during a half semester at the Physics Department, Brawijaya University, Indonesia - (2012).

## SELECTED TALKS

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- Flash talk for early-career researcher at a plenary session of the Euclid Consortium Meeting 2022, April, 2022, *Spatially resolving stellar population properties of local galaxies with Euclid + Rubin data.* (website)
- Talk at a parallel session "Legacy Science Local Universe" of the Euclid Consortium Meeting 2022, April, 2022, *Spatially resolving stellar population properties of local galaxies with Euclid + Rubin data.* (website)
- Contributed talk at the Japan-Korea-Taiwan Joint Galaxy Evolution Workshop 2021, ASIAA, Taiwan (virtual), February, 2022, *Spatially resolved panchromatic SED fitting of nearby galaxies: resolved properties of stars, dust, and gas.* (website)
- **(Invited)** Science talk at monthly teleconference meeting of the LU-SWG (Local Universe Science Working Group), PPZ (Physical Parameters and Redshifts) of the Euclid project, November, 2021, *Dissecting galaxies with pixelized SED fitting (piXedfit).*
- **(Invited)** Colloquium at the Graduate Institute of Astronomy, National Central University (NCU), Taiwan, April, 2021, *Spatially resolving properties of galaxies across cosmic time with piXedfit.* (website)
- **(Invited)** Give a science talk at the teleconference of the CANDELS SED fitting working group, March, 2021, *Spatially resolving properties of galaxies across cosmic time with piXedfit.* (website)
- **(Invited)** Colloquium at the Astronomy Department, Institut Teknologi Bandung (ITB; Bandung Institute of Technology), Indonesia (virtual), February, 2021, *Spatially resolving properties of galaxies across cosmic time with piXedfit.* (website, video)
- Contributed talk at the Japan-Korea-Taiwan Joint Galaxy Evolution Workshop 2020, ASIAA, Taiwan (virtual), February, 2021, *Spatially resolved spectrophotometric SED fitting of galaxies with piXedfit.* (website)
- **(Invited)** Colloquium at the Institute of Astronomy, National Tsing Hua University (NTHU), Taiwan, June, 2020, *Spatially resolving properties of galaxies across cosmic time with piXedfit.* (website)
- Contributed talk at workshop Galaxy formation and evolution across cosmic time, ASIAA, Taiwan, December, 2019, *Spatially resolving properties of galaxies across cosmic time with piXedfit.* (website)
- **(Invited)** Colloquium at ASIAA, Taiwan, June, 2019, *Study spatially resolved stellar population properties of galaxies with spatially resolved SED fitting.* (website)
- Contributed talk at the IAU Symposium 341: PanModel2018: Challenges in panchromatic galaxy modelling with next generation facilities, Osaka University, Japan, November, 2018, *Spatially resolved stellar mass buildup and quenching in massive disk galaxies over the last 10 Gyr revealed with spatially resolved SED fitting.* (website, proceeding)
- Contributed talk at the Galaxy Evolution Workshop, Ehime University, Japan, June, 2018, *Spatially resolved stellar mass buildup and quenching in massive disk galaxies at  $0 < z < 1$ .* (website)
- Colloquium at the Astronomical Institute, Tohoku University, Japan, April, 2018, *Spatially resolved stellar mass buildup and quenching in massive disk galaxies at  $0 < z < 1$ .* (website)
- Contributed talk at the workshop Sharp views of galaxy formation and evolution, Japan-Germany workshop, Tohoku University, Japan, November, 2017, *Evolution of the spatially resolved star formation main sequence of massive disk galaxies at  $0 < z < 1$ .* (website)
- **(Invited)** Online Galaxy workshop (Galshop), virtual (NAOJ, Subaru telescope, and Tohoku University), June, 2017, *Understanding the scatter in the spatially resolved star formation main sequence.* (website)
- Contributed talk at the conference How galaxies form stars, Stockholm University, Sweden, August, 2016, *Spatially resolved star formation rate and stellar mass of local massive spiral galaxies: understanding the scatter in spatially resolved star formation main sequence.* (website)
- Contributed talk at The 3rd galaxy evolution workshop, Tohoku University, Japan, June, 2016, *Spatially-resolved star formation rate and stellar mass of galaxies in the local universe: quantifying the inside-out scenario of disk galaxies formation.* (website)
- Colloquium at the Astronomical Institute, Tohoku University, Japan, May, 2015, *Spatially resolved star formation rate density and stellar mass density of galaxies in the local universe.* (website)

## POSTER PRESENTATIONS

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- 2020 Annual Meeting of The Astronomical Society of the Republic of China (Taiwan), ASIAA, Taiwan, September, 2020, *Spatially resolving properties of galaxies across cosmic time with  $\text{pixeDFIT}$* . (website)
- The art of measuring galaxy physical properties, INAF-IASF, Italy, November, 2019, *Spatially resolving properties of galaxies across cosmic time with  $\text{pixeDFIT}$* . (website, proceeding)
- Panoramas of the evolving cosmos, The 6th Subaru international conference, Hiroshima, Japan, November, 2016, *Spatially resolved star-formation main sequence in the local massive spiral galaxies*. (website, proceeding (P17))
- Science and Life Science Joint Symposium 2015, Tohoku University, Japan, February, 2015, *Spatially resolved star formation rate density and stellar mass density of massive galaxies in the local universe*

## TELESCOPE TIME

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- Co-investigator, ALMA band 6 observation, October, 2021, *Directly measuring black hole mass of a quenched galaxy at  $z = 2.1$* , Takahiro Morishita, **Abdurro'uf**, Dan Coe, Massimo Stiavelli.
- Co-investigator, 1 night observation with Hectospec at the MMT telescope, Arizona, USA, October, 2021, *Unveiling the nature of isolated massive slow-rotating early-type galaxies*, Hung-Jin Huang, Xiaohui Fan, **Abdurro'uf**, Yen-Ting Lin, Tim Eifler.
- Co-investigator, 8 nights observation with KOOLS-IFU at the SEIMEI telescope, Okayama, Japan, May, 2021, *A new population of extreme starburst galaxies at intermediate redshifts*, Masayuki Akiyama, Xiaoyang Chen, Yoshiki Toba, Mitsuru Kokubo, **Abdurro'uf**, Yamamura Issei, Toshihiro Kawaguchi, Hirofumi Noda, Koki Terao, Kohei Ichikawa.
- Co-investigator, 1.4 nights observation with GMOS-N at Gemini-North, Hawaii, USA, March, 2021, *Mechanism behind co-existence of extreme outflows and starbursts in ULIRGs*, Xiaoyang Chen, Masayuki Akiyama, Kohei Ichikawa, Yoshiki Toba, T.Kawaguchi, Hirofumi Noda, Yamamura Issei, Mitsuru Kokubo, **Abdurro'uf**, Bovornpratch Vajarnwannaluk.
- Co-investigator, 8 nights observation with KOOLS-IFU at the SEIMEI telescope, Okayama, Japan, December, 2020, *A new population of extreme starburst galaxies at intermediate redshifts*, Masayuki Akiyama, Xiaoyang Chen, Yoshiki Toba, Mitsuru Kokubo, **Abdurro'uf**, Yamamura Issei, Toshihiro Kawaguchi, Hirofumi Noda, Koki Terao, Kohei Ichikawa.
- Co-investigator, 3 nights observation with Hectospec at the MMT telescope, Arizona, USA, October, 2020, *Unveiling the nature of isolated massive slow-rotating early-type galaxies*, Hung-Jin Huang, Xiaohui Fan, **Abdurro'uf**, Yen-Ting Lin, Tim Eifler.
- Co-investigator, 4 nights observation with Hectospec at the MMT telescope, Arizona, USA, June, 2020, *Unveiling the nature of isolated massive slow-rotating early-type galaxies*, Hung-Jin Huang, Xiaohui Fan, **Abdurro'uf**, Yen-Ting Lin, Tim Eifler.
- Co-Investigator, 1 night observation with FOCAS at the Subaru Telescope, Hawaii, USA, March, 2017, *New Search for Luminous Type-2 QSOs at Intermediate Redshifts*, Masayuki Akiyama, Hirofumi Noda, Tatsuro Watanabe, **Abdurro'uf**, Yongming Liang, Tian Qiu, Juming Yu, Guangwen Chen.

## PUBLIC OUTREACH

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- (**Invited**) Give an online public lecture entitled *Astrostatistics and Big data for understanding the evolution of the universe* at the Department of Physics, Brawijaya University, Indonesia - (October, 2021). (website, proceeding)
- (**Invited**) Give a talk on introduction of astronomy and its application on the lunar and Gregorian calendar at a regular meeting of Indonesian student community in Taipei Medical University (TMU), Taipei, Taiwan - (December, 2020).
- (**Invited**) Give a talk on introduction of astronomy and its application on the lunar and Gregorian calendar at a regular meeting of Indonesian student community in Taipei, Taiwan - (December, 2020). (website)
- Serve as a tutor in a short course on radio astronomy observation for Japanese high school students in Sendai City Observatory, Sendai, Japan - (November, 2014).

## ATTENDANCE IN SUMMER SCHOOL OR WORKSHOP

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- The 11th Prime Focus Spectrograph (PFS) collaboration meeting 2019, California Institute of Technology (Caltech), Pasadena, USA - (December, 2019). (website)
- TIARA summer school on Astrostatistics and Big data, ASIAA, Taipei, Taiwan - (September, 2017). (website)
- Thirty Meter Telescope (TMT) Science Forum, Kyoto, Japan - (May, 2016). (website)

# PUBLICATIONS

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Full list of my publications can be seen at ADS [here](#)

## *First author papers*

1. **Dissecting Nearby Galaxies with `pixedfit`: II. Spatially Resolved Scaling Relations Among the Stars, Dust, and Gas**,  
[Abdurro'uf](#), Yen-Ting Lin, Hiroyuki Hirashita, Takahiro Morishita, Sandro Tacchella, Po-Feng Wu, Masayuki Akiyama, Tsutomu T. Takeuchi, 2022, accepted for publication in *ApJ*, arXiv:2207.08382. (ADS)
2. **Dissecting Nearby Galaxies with `pixedfit`: I. Spatially Resolved Properties of Stars, Dust, and Gas as Revealed by Panchromatic SED Fitting**,  
[Abdurro'uf](#), Yen-Ting Lin, Hiroyuki Hirashita, Takahiro Morishita, Sandro Tacchella, Masayuki Akiyama, Tsutomu T. Takeuchi, Po-Feng Wu, 2022, *ApJ*, 926, 81. (ADS)
3. **Introducing `pixedfit`: A Spectral Energy Distribution Fitting Code Designed for Resolved Sources**,  
[Abdurro'uf](#), Yen-Ting Lin, Po-Feng Wu, and Masayuki Akiyama, 2021, *ApJS*, 254, 15. (ADS)
4. **Evolution of Spatially Resolved Star Formation Main Sequence and Surface Density Profiles in Massive Disc Galaxies at  $0 < z < 1$ : Inside-out Stellar Mass Buildup and Quenching**,  
[Abdurro'uf](#) & Masayuki Akiyama, 2018, *MNRAS*, 479, 5083. (ADS)
5. **Understanding the Scatter in the Spatially Resolved Star Formation Main Sequence of Local Massive Spiral Galaxies**,  
[Abdurro'uf](#) & Masayuki Akiyama, 2017, *MNRAS*, 469, 2806. (ADS)

## *Co-author papers*

1. **The Seventeenth Data Release of the Sloan Digital Sky Surveys: Complete Release of MaNGA, MaStar and APOGEE-2 Data**,  
[Abdurro'uf](#), Katherine Accetta, Conny Aerts, Victor Silva Aguirre, Romina Ahumada, Nikhil Ajgaonkar, N. Filiz Ak, Shadab Alam, Carlos Allende Prieto, Andres Almeida, Friedrich Anders, Scott F. Anderson, Brett H. Andrews, et al., 2022, *ApJS*, 259, 35. (ADS)
2. **Extremely Low Molecular Gas Content in the Vicinity of a Red Nugget Galaxy at  $z = 1.91$** ,  
T. Morishita, Q. D'Amato, L. E. Abramson, [Abdurro'uf](#), M. Stiavelli, R. A. Lucas, 2021, *ApJ*, 908, 163. (ADS)
3. **Tracing the Coevolution Path of Supermassive Black Holes and Spheroids with AKARI-selected Ultraluminous IR Galaxies at Intermediate Redshifts**,  
Xiaoyang Chen, Masayuki Akiyama, Kohei Ichikawa, Hirofumi Noda, Yoshiki Toba, Issei Yamamura, Toshihiro Kawaguchi, [Abdurro'uf](#), Mitsuru Kokubo, 2020, *ApJ*, 900, 51. (ADS)
4. **Discovery of a strong ionized-gas outflow in an AKARI-selected ultra-luminous infrared galaxy at  $z = 0.5$** ,  
Xiaoyang Chen, Masayuki Akiyama, Hirofumi Noda, [Abdurro'uf](#), Yoshiki Toba, Issei Yamamura, Toshihiro Kawaguchi, Mitsuru Kokubo, Kohei Ichikawa, *PASJ*, 71, 29. (ADS)

## *Selected proceeding*

1. **Spatially Resolved stellar mass buildup and quenching in massive disk galaxies over the last 10 Gyr revealed with spatially resolved SED fitting**,  
[Abdurro'uf](#) & Masayuki Akiyama, 2020, Challenges in Panchromatic Modelling with Next Generation Facilities. Proceedings of the International Astronomical Union, 341, 55. (ADS)